Electronic Supplementary Information

Enhanced oxygen evolution activity of graphitic carbon shell embedded nickel/nickel oxide core-shell nanoparticles via surface dissolution

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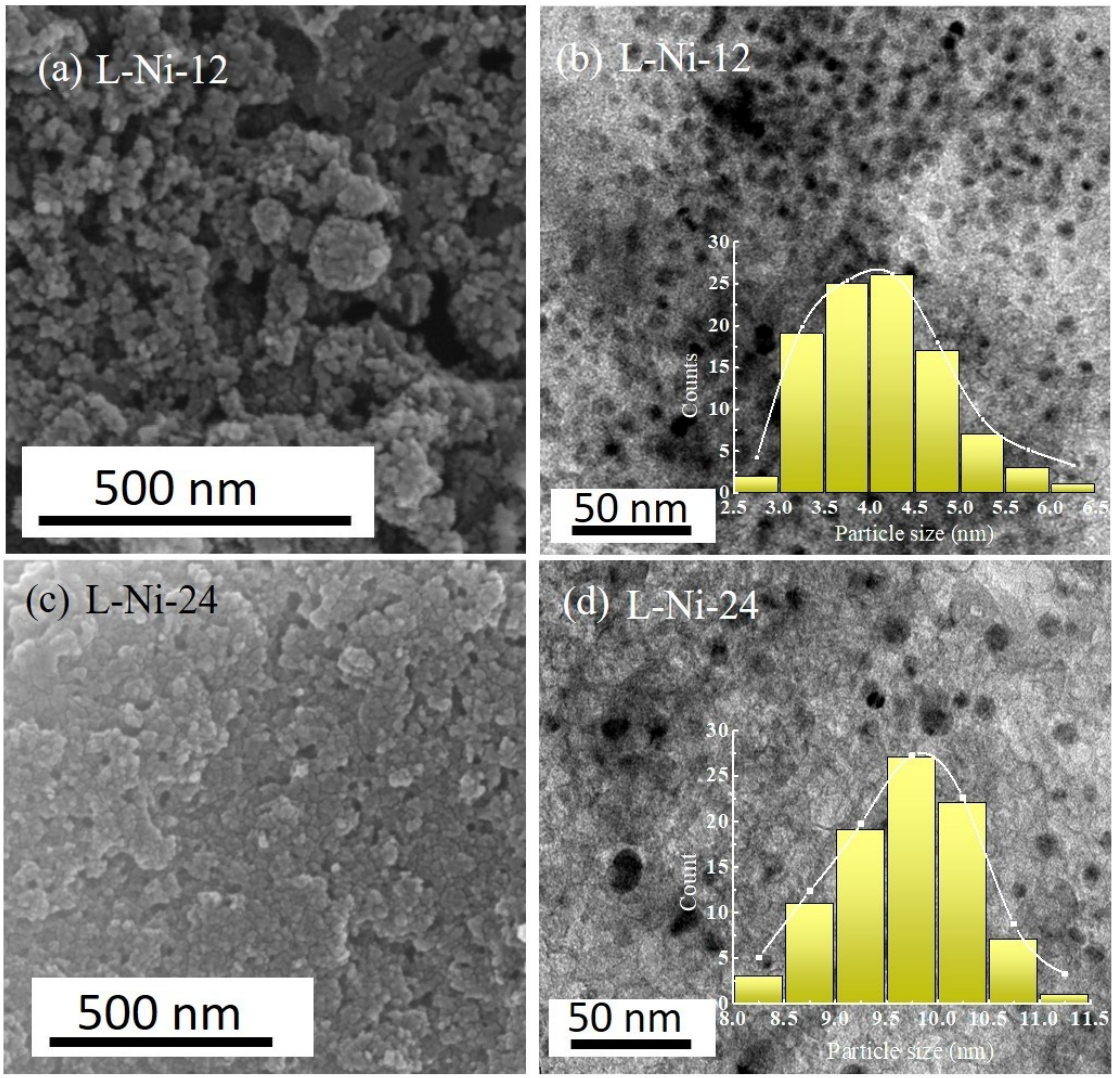

Figure S1: SEM images (a), (c) at low magnification showing the morphologies and particle size distribution plots from TEM images (b) and (d).

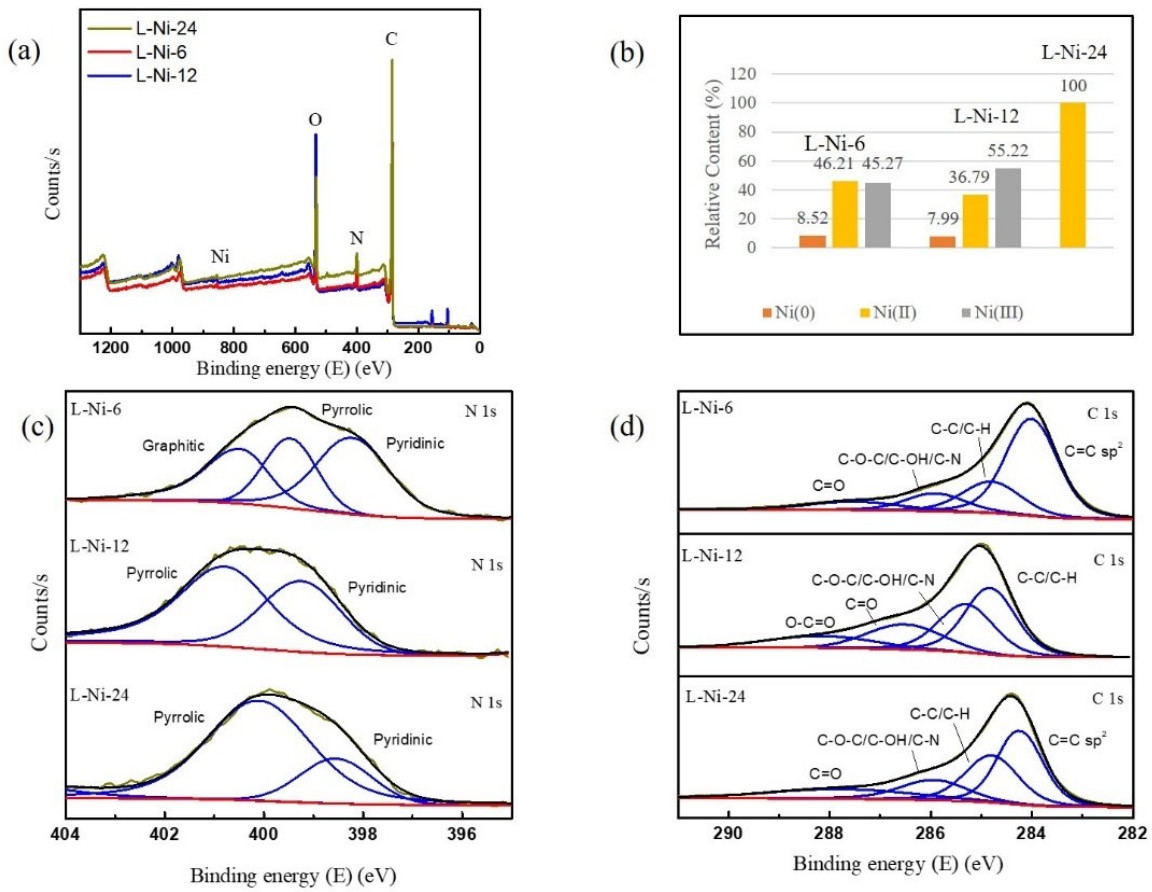

Figure S2: (a) XPS survey spectra of all the samples confirming the elements present. (b) Relative percentage of various oxidation states of nickel present in the samples (c) High-resolution N 1s spectra and (d) C 1s spectra.

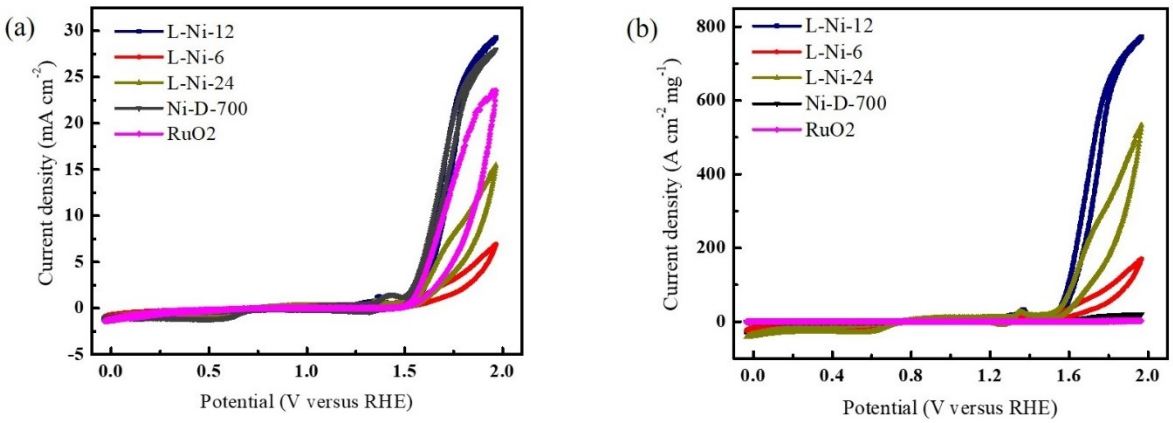

Figure S3: (a) Cyclic voltammograms sweeped at the scan rate of 20mV/s between 0 to 2V vs. RHE in N_2 saturated 1 M KOH where current density is normalized against geometric surface area. (b) The same CV plots with current density normalized against the mass of the active metal present in each of the catalyst.

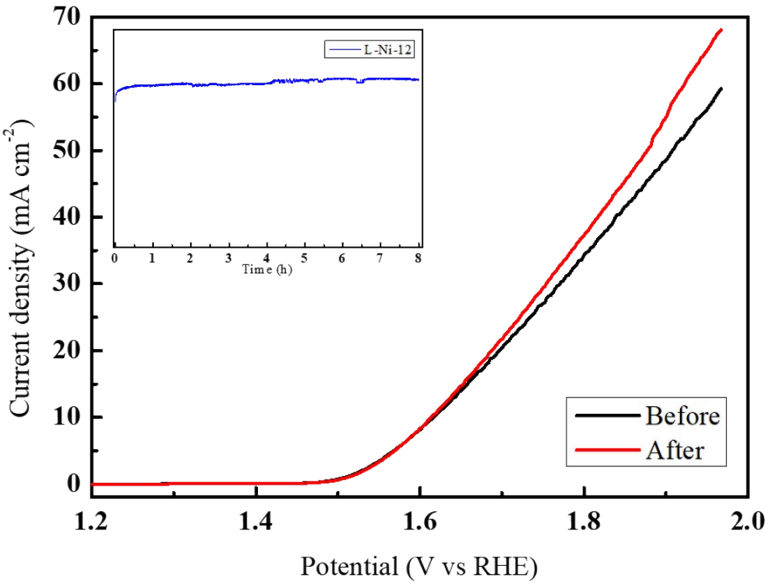

Figure S4: OER activity of the sample before and after 8 hours of Chronoamperometry test (inset) on L-Ni-12 at 1.55V vs. RHE in N_2 saturated 1 M KOH.

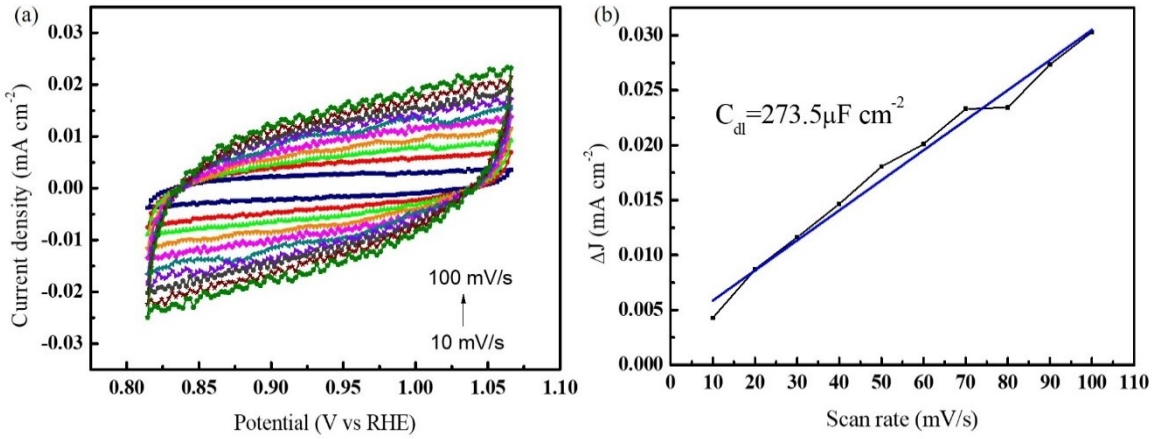

Figure S5: (a) Cyclic voltammograms were programmed at the scan rate of 10 to 100mV/s in the non-faradaic region for electrochemical double-layer measurements in N_2 saturated 1 M KOH. (b) Capacitive current density against scan rate where the slope gives C_{dl} value for the catalyst L-Ni-12.

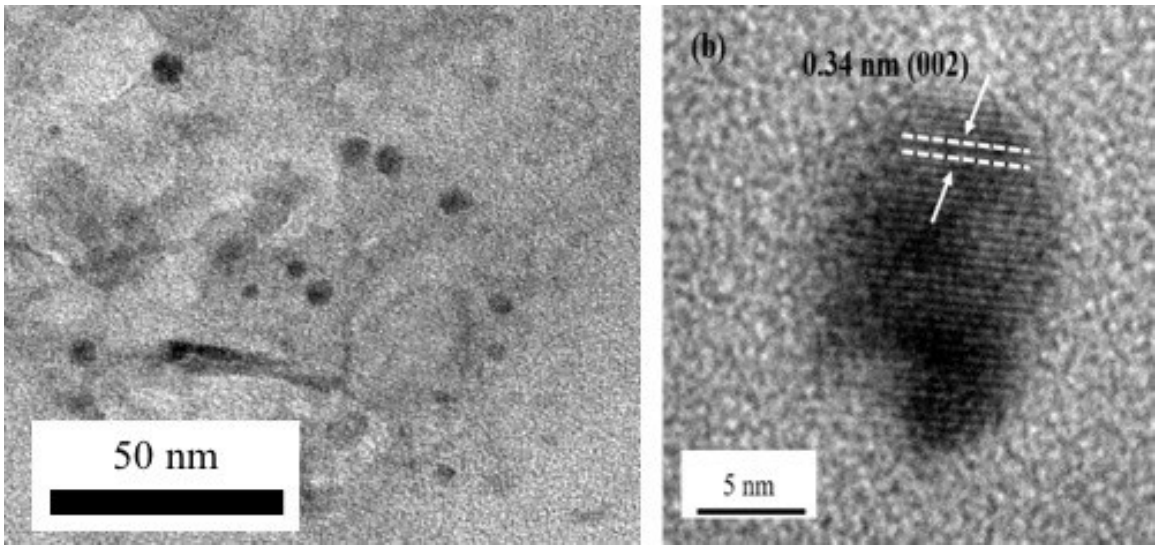

Figure S6: TEM image (a) and HR-TEM image (b) of L-Ni-12 after OER operation.

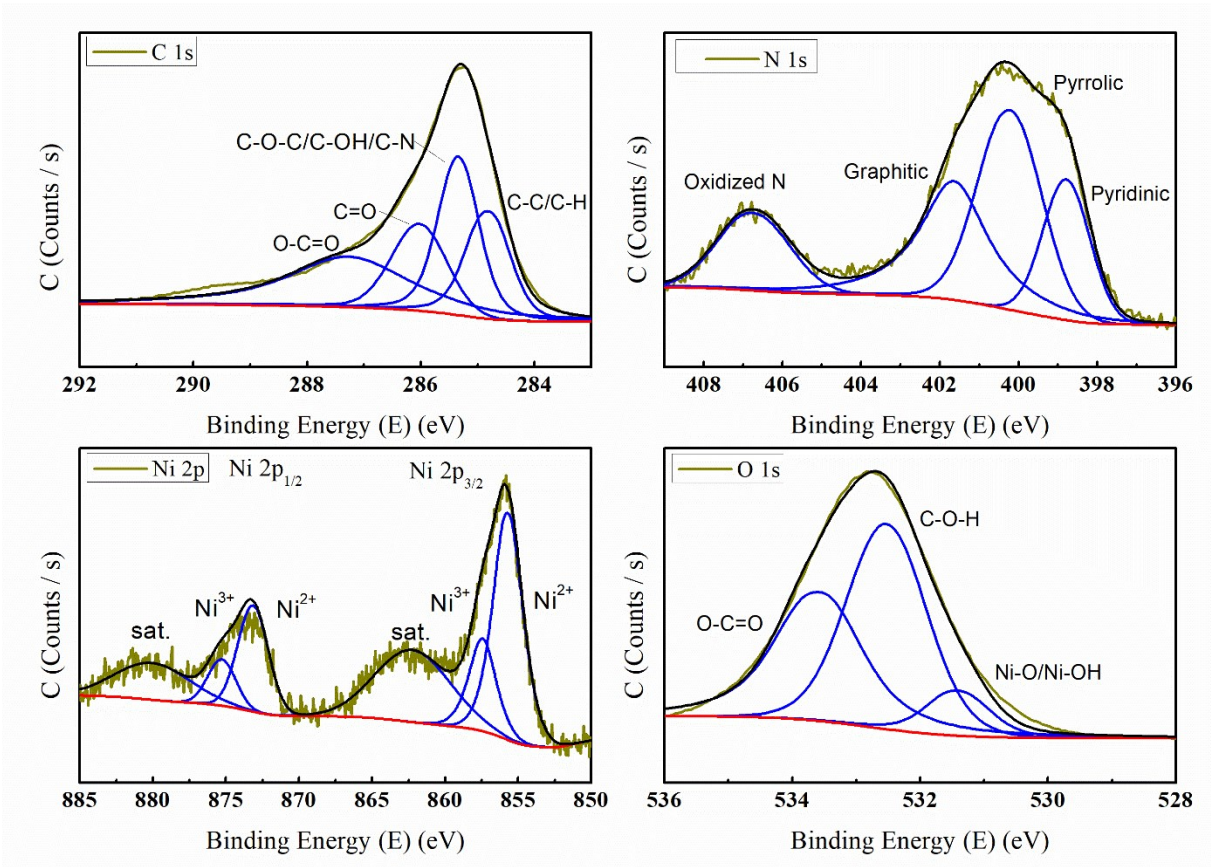

Figure S7: XPS results of L-Ni-12 post OER catalysis.

Sample	Onset potential (V vs. RHE)	Overpotential(η) at 10 mA cm^{-2} (mV)	Tafel Slope (mV dec^{-1})	Charge transfer resistance (R_{ct}) (ohms)
L-Ni-6	1.65	-	96.89	770
L-Ni-12	1.52	360	53.4	290
L-Ni-24	1.68	-	124.3	568
Ni-D-700	1.55	410	81.3	70
RuO_2	1.51	390	-	-

Table S1: Summary of electrocatalytic performance of the samples.

Electrocatalyst	Mass Loading (mg cm^{-2})	Overpotential(η) at 10 mA cm^{-2} (mV)	Tafel Slope (mV dec^{-1})	Electrolyte	Reference
Ni-NC700	0.31	430	66	0.1 MKOH	[1]
NiFeP@NPC	0.4	350	78	1 MKOH	[2]
$NiFe_2O_4$	2	381	46.5	1 MKOH	[3]
O-NiCoFe-LDH	0.12	430	60	0.1 MKOH	[4]
CoP@SNC	0.6	350	68	1 MKOH	[5]
CoP/Co-N-C/NPC	-	374	92	1 MKOH	[6]
Ni@NC-800	0.8	290	45	1 MKOH	[7]
$NiCo_2O_4$	-	440	164	0.1 MKOH	[8]
5%Ni-Co	0.4	381	72.5	0.1 MKOH	[9]
Ni_3Fe/NC	0.13	370	77	0.1 MKOH	[10]
L-Ni-12	0.07	360	53.4	1 MKOH	This work

Table S2: Comparison of electrocatalytic performance of some of the related transition metal based electrocatalyst to our catalyst.

References:

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